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ABSTRACT

The publication contains an outline for use by agriculture teachers in developing a teaching plan for a unit on paints and preservatives. The topics included are (1) recognizing, solving, and preventing paint problems and (2) operating and using power spray painting equipment. Items presented for each topic are: the situation, (intended to inform the teacher of the type and level of the material), teacher objectives, examples of teaching procedures, problems and concerns of students, student objectives, references for teacher and student use, sample student activities, and suggested means for evaluation. A detailed technical information section for each of the two topics provides some of the information needed to teach the unit. For the subject area of paint problems, the causes, prevention, remedies, and an illustration of 34 problems are given. Spray painting material (correlated with eight transparency masters) includes descriptions of basic equipment, spraying procedure, Occupational Safety and Health Administration approved spray painting room, the construction of spray booths, and 12 problems associated with spray painting and their causes and solutions. The guide contains an 11-page glossary of common painting terms and a list (with addresses) of 17 major paint and painting equipment companies. (MS)

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PAINTS AND PRESERVATIVES

CURRICULUM MATERIALS FOR AGRICULTURE EDUCATION

COLLEGE OF EDUCATION
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
BLACKSBURG, VIRGINIA 24061

IN COOPERATION WITH

AGRICULTURAL EDUCATION SERVICE, DIVISION OF VOCATIONAL EDUCATION
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RICHMOND, VIRGINIA 23216

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1975

PAINTS AND PRESERVATIVES

Curriculum Materials
for
Agricultural Education

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Edited by
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Appreciation is expressed to the referenced paint companies and associations for supplying material and information used throughout this publication and to Dr. Larry E. Miller, Professor Agricultural Education, for his guidance and assistance in preparing these materials. Further acknowledgement is also given to Mr. Kern Houff for his finalization of this teaching unit.

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Education Field Service Publication

HOW TO USE THIS OUTLINE

This publication contains teaching outlines on problem areas concerning paints and preservatives. It is for use by teachers of agriculture as a guide in developing a teaching plan. The various sections of the outline are intended to be used as follows:

Problem Areas: Because of its size, the unit is divided into problem areas for detailed analysis and study. From this point on in teaching, content treatment should be for one problem area at a time.

Situation: This is intended to give the teacher some insight into what type of material is contained within the unit and to what level it is directed. He then may need to analyze the local situation and determine whether or not the unit is appropriate.

Teacher Objectives: These are for the teacher's use only. They indicate the abilities the teacher expects the students to develop as a result of studying the unit.

Teaching Procedures: This is to aid the teacher by suggesting activities that may be helpful in teaching the unit. However, the teacher should supplement other activities relevant to his local situation to improve the effectiveness of the unit.

Problems and Concerns: This section reflects things the student should know about each problem area in order to accomplish their objectives.

Student Objectives: These should be given to the student in order that he will know what will be expected of him upon completion of the unit.

Technical Information: This section was organized so that the teacher would have some of the technical information needed to teach the unit. The section is given in outline form and should not be used as the only source of information for teaching the unit. Due to the outline form, further research should be done by the teacher in order to fully explain the information.

References: A suggested list of references is included for each problem area. Some of these are for teacher use and some for student use. This is not a complete list and the teacher should use all available references in the study of this unit.

Student Activities: This is a list of suggested events and activities. Those used should be planned well in advance.

Evaluation: This is a suggested means of evaluating how well the student has accomplished the objectives set forth at the beginning of the unit.

Transparencies: Please note that pages 45 - 59 are identified with a T- and are intended to be used as Transparency Masters for the Operating and Using Power Spray Painting Equipment Problem Area.

Enterprise: Agricultural Mechanics

Unit: Paints and Preservatives

Problem Area: Recognizing, Solving, and Preventing Paint Problems

Situation:

1. This is intended for a class of high school students, not necessarily agricultural students, desiring to learn about recognizing, solving, and preventing paint problems.
2. Students have little knowledge of this subject matter.
3. Economically, this subject matter will be of great importance to students.

Teacher Objectives:

Upon completion of this problem area, the student will be able:

1. To recognize or identify different paint problems.
2. To correctly list one (1) or more solutions to each identified paint problem.
3. To list one (1) method of prevention for each identified paint problem

Teaching Procedures:

Motivation:

SHOW: A picture of a house that has recently been painted.

SHOW: A picture of that same house before it was painted.

ASK: What house would you rather own?

SHOW: Sample boards which are examples of paint problems.

ASK: What are wrong with these?

ASK: What caused the problems?

ASK: How could we prevent this from happening?

ASK: Is it important to correct paint problems, such as these, or should you let them continue? Why?

Problems and Concerns:

1. What are paint problems?
2. How can you prevent them?
3. Can you control them once you have these problems?

Student Objectives:

Upon completion of this problem area, the student will be able:

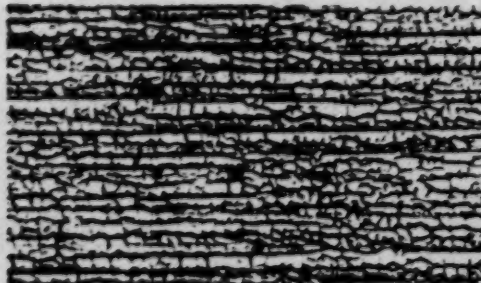
1. To identify several different paint problems.
2. To correctly list one (1) or more solutions to each paint problem.
3. To list (1) method of prevention for each identified paint problem.

Technical Information:

Much time, money, and frustration is spent each year by homeowners, factory owners, business people, and the like, who have to scrub, scrape, replace and repaint their possessions each year so that their property will look good. These people are faced with paint problems and many do not know how to handle them. Therefore, it would be very beneficial to learn to recognize various paint problems, and also to be able to solve and prevent these problems economically.

The following pages contain a picture of the problem, its name, and causes, prevention, and remedies of each. For better pictures of each condition please refer to the asterisked (*) references. These problems may be encountered with either a brush, roller, or sprayer.

1. ALLIGATORING



Cause: The previous paint film was applied in several heavy coats without sufficient drying time between coats--or--use of an undercoater that was not formulated for finish coats.

Solution or Remedy:

- A. Sand cracked or alligatored surface smooth.
- B. Apply one coat of undercoater and one top coat of recommended paint, according to label directions.

2. BLEEDING

Causes:

- A. Finishing with a light color over a bleeding red or maroon.
- B. Improper cleaning of the spray gun following application of bleeding colors.

PREVENTION:

- A. Seal with Stop Bleed over bleeding reds and maroons.
- B. Be sure the gun is thoroughly clean.
- C. Avoid sanding or spraying bleeding colors in the vicinity of another product that is to be refinished with a light color.

REMEDY:

The film must be sealed with a special sealer designed to prevent bleeding, or else the old finish must be removed.

3. BLISTERING

CAUSES:

- A. Moisture trapped in wood is drawn from the wood by the sun's heat and pushes the paint from the surface.
- B. Applying lacquer-type materials, too heavy with thinner, which dries too rapidly for the spray condition.

- C. Unusual continued, high humidity and continued rain, particularly when accompanied by rapid changes in temperature, contribute to blistering.
- D. Moisture from wet sanding.
- E. Silicone contamination on the old finish.

TO PREVENT:

- A. Follow label directions - avoid heavy coats. Use proper thinner according to weather and shop conditions.
- B. Locate and eliminate sources of moisture. Consider installing moisture escape devices, such as attic louvers, exhaust fans, wedges, and vents.
- C. Sand surface to fresh wood and spot prime.
- D. Seal all seams, holes, and cracks against moisture entry.
- E. Scrape off old paint on board or metal showing blistering and exposed wood - or scrape off old paint around blistered area approximately 12" away from blister condition.

REMEDY:

Affected area must be sanded to a smooth finish below the blistering and, in extreme cases, the finish must be removed to the metal or wood and refinished.

4. BLUSHING

Causes:

- A. High humidity, cold, damp surface. Hot, sultry, or rainy weather.
- B. Fast drying or poorly balanced acrylic lacquer thinners.

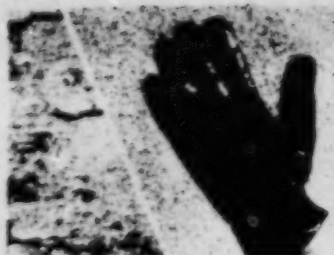
TO PREVENT:

- A. Keep shop at normal temperature (70°) and use correct thinner for weather conditions.
- B. Always use a good quality thinner and thin material according to directions.

REMEDY:

When blushing appears, add a retarder to the reduced color and apply two or more coats as needed.

5. CHALKING



CAUSES:

- A. Inadequate surface preparation which causes paint to powder and chalk off.
- B. All finishers will chalk to some extent, but improper stirring of materials contributes to more chalking.
- C. Improper thinner or reducer.
- D. Incorrect use of additives.
- E. Exposure to industrial fallout, chemical fumes, or prolonged exposure to the sun.

TO PREVENT:

- A. Stir materials thoroughly to be sure all pigment is in solution.
- B. Use the proper thinner or reducer.
- C. Use only additives recommended, and in accordance with label directions.
- D. Avoid prolonged exposure to chemical fumes and industrial fallout. Wash frequently if such exposure is necessary. Avoid the use of harsh detergents in washing, also.

REMEDY:

Compound and polish the affected area to remove "dead" pigment and oxidation.

6. CHECKING AND CRACKINGCAUSES:

- A. Plywood veneer cracked from expansion and contraction as it weathers and ages.
- B. Application over old finish already checked.

- C. Application over primer or primer-surfacer which has not dried thoroughly.
- D. Applying excessively heavy coats or recoating too quickly, particularly with acrylic lacquers.
- E. Material not properly stirred or uniformly mixed.
- F. Excessive film thickness.

• TO PREVENT:

- A. Sand surface smooth and fill cracks with chalk.
- B. Inspect old finish thoroughly and remove it prior to refinishing if checking or cracking is present.
- C. Undercoats must be thoroughly dry prior to color coating.
- D. An improper undercoat can be softened by color solvent, causing shrinkage in the undercoat resulting in checking or cracking of the color coat.
- E. Avoid heavy, thick coats. Allow sufficient drying time between coats; otherwise, surface film dries hard while underneath coats are still soft. As these coats dry, film shrinkage occurs, which results in checking or cracking.
- F. All materials must be thoroughly stirred or mixed.
- G. Avoid excessive film thickness. Paint film in excess of 4½ to 6 mils will usually crack and check.

REMEDY:

Affected areas must be sanded to a smooth finish below the checking or cracking. In severe cases, all of the finish must be removed to the metal or wood and refinished.

7. COLOR WON'T MATCH

CAUSES:

- A. Paint is not properly stirred.
- B. Old finished is weathered and oxidized.
- C. Original finish has "drifted" from the manufacturer's standard.
- D. Improper application, particularly true in metallic colors.
- E. Improper thinner or reducer.

TO PREVENT:

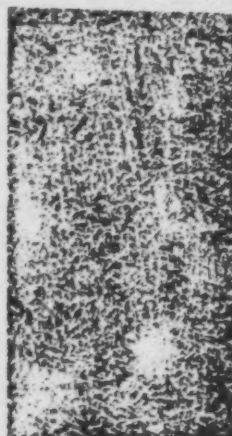
- A. Stir color thoroughly as all color pigment must be properly dissolved and mixed to get true color.
- B. Thoroughly clean and compound old finish to "renew" color as much as possible. Tinting of refinish color is sometimes necessary to compensate for fade.
- C. "Color Drift" means the color on the object has drifted from the original standards. Refinish color must be tinted in such cases.
- D. Variations in air pressure, reduction, and shop ventilation can materially affect the trueness of color in high metallics. Higher air pressure usually makes color lighter, lower air pressure darker. Under-thinning usually makes colors darker, over-thinning lighter. Wet coats will be darker, dried coats will make color lighter. Cool shops generally cause color to be darker, warm shops lighter.

- E. Improperly balanced thinners or reducers frequently do not have sufficient solvency to properly dissolve color pigment to give trueness of color.

REMEDY:

Check the trueness of color before painting the entire area. Also adjust air pressure, reduction, etc., in order to more nearly duplicate the spray technique used in applying the previous finish. Tint the color if necessary.

8. CRAZING



CAUSES:

- A. Shop temperatures are too cold or too hot.
- B. Condition of old surface.
- C. Improper thinner or reducer.

TO PREVENT:

- A. Shop temperatures are at or near normal temperature (70°).
- B. Be sure no checking or crazing is prevalent in the old finish.
- C. Use quality thinner or reducer.

REMEDY:

Spray wet coats of over reduced color, containing a retarder, until crazing pattern "melts in."

9. CURDLING

- A. Using a synthetic reducer to thin acrylic or lacquers.
- B. "Shocking" synthetic reducer by pouring reducer in too fast.
- C. Inferior thinner or reducer.

TO PREVENT:

- A. Add acrylic lacquer thinners to thin lacquer type materials.
 - B. Add enamel reducer slowly.
 - C. Use proper acrylic lacquer thinner or enamel reducers.
- CAUTION - Do not pour back reduced material.

REMEDY:

Do not use curdled materials.

10. FISH EYESCAUSES:

- A. Surface not properly cleaned.
- B. Contamination in old finish.

TO PREVENT:

- A. Clean surface thoroughly.
- B. Add additives to color coat in accordance with label directions.

REMEDY:

Generally, a double coat of color sprayed over the affected area will correct the condition. If not, remove and refinish.

11. FLAKINGCAUSES:

- A. Wood alternately swells and shrinks as moisture from behind it is absorbed and then dries out. Brittle paint film cracks under strain and pulls away from wood.

TO PREVENT:

- A. Locate and eliminate sources of moisture.
- B. Consider installing moisture escape devices such as attic louvers, exhaust fans, wedges and vents.
- C. Scrape off old paint on board showing flaking and expose wood - or scrape off old paint around flaking area approximately 12" away from the flaking condition.

REMEDY:

- A. Sand the surface to fresh wood or metal and spot prime.

12. FLATTENING - DULLINGCAUSES:

- A. Presence of wax, oil, or other foreign matter remaining in the old paint film.
- B. Applying finish material over an undercoat not thoroughly dry.
- C. Porous undercoat or porous old finish.
- D. Over thinning or reducing.
- E. Compounding or polishing acrylic lacquer before it is sufficiently dry.
- F. Inferior thinner or reducer.
- G. Inadequate ventilation in the drying room.

TO PREVENT:

- A. Clean the old finish thoroughly with the proper solvent cleaner.
- B. Be certain the undercoat is thoroughly dry.
- C. Avoid over reduction. Follow label directions.
- D. Acrylic lacquer should dry at least four hours before compounding preferably overnight.
- E. Maintain proper shop temperature (70°) with adequate ventilation. Air circulation is particularly important after spraying enamels.

REMEDY:

If gloss can't be restored by polishing or compounding, clean, sand and refinish.

13. GRITTIENESS - SEEDINESSCAUSES:

- A. Improper stirring.
- B. Failure to strain material.
- C. Old material.
- D. Improper reducer.

TO PREVENT:

- A. Stir thoroughly to be sure all pigment is in solution.
- B. Strain all colors and synthetic undercoats.
- C. Material that is too old to stir or strain properly should not be used. Repeated straining will not remove seediness.
- D. Use the proper reducer.

REMEDY:

Sand to a smooth finish and refinish.

14. LIFTINGCAUSES:

- A. Applying acrylic lacquer over uncured air dry enamel.
- B. Surface not properly cleaned. Presence of silicone-type polishes.
- C. When acrylic enamel is used and recoating is done during the critical period.

TO PREVENT:

- A. Avoid acrylic lacquer solvents. They dissolve air dry enamel, causing "lift."
- B. Old finish must be thoroughly clean.

REMEDY:

Finish where lifting occurs must be removed, and then refinished. If sealer will not hold down the old finish, it must be removed prior to refinishing.

15. LIVERING (Gelling)CAUSES:

- A. Chemical reaction in can.

REMEDY:

- A. Do not use livered or gelled materials.

16. LOCALIZED PEELINGCAUSES:

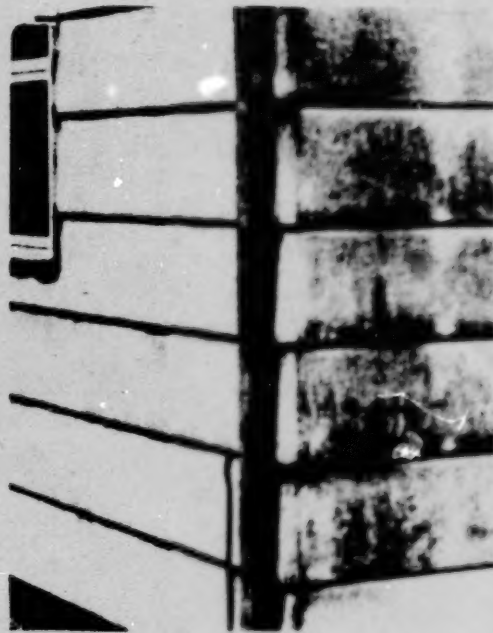
A. Moisture trapped in siding is drawn from wood by the sun's heat and pushes the paint from the surface.

TO PREVENT:

- A. Locate and eliminate sources of moisture.
- B. Consider installing attic louvers, wedges, and vents to allow trapped moisture to escape.
- C. Scrape off old paint showing peeling and expose material - or scrape off old paint around peeling area approximately 12" away from peeling condition.

REMEDY:

Sand surface to fresh wood or metal and spot prime. Follow this by sealing all seams, holes, and cracks against moisture entry.

17. MildewCAUSES:

- A. It is a plant growth which grows well on certain surfaces.
- B. It thrives on high humidity and high temperature which stimulates fungus growth on the paint film.
- C. If left on the surface and painted over, it will grow through the new coat of paint.

TO PREVENT:

- A. Scrub the entire surface with a solution of 1/3 cup powdered detergent, and 1/2 cup household bleach in four quarts of warm water.
- B. Follow this up with an application of mildew-resistant paint.

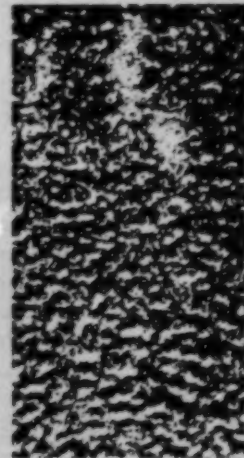
18. NAILHEAD STAINING

CAUSES:

- A. Excessive moisture contributes to rusting of uncoated steel nails used in construction.

TO PREVENT:

- A. Locate and eliminate sources of moisture.
- B. Sand or wire brush stained paint and remove rust down to bright metal of nailhead.
- C. Countersink nailhead 1/8" below the surface of the wood.
- D. Immediately spot prime countersunk nailhead with any recommended House Paint undercoater.
- E. Fill primed, countersunk holes and nailheads with caulking.

19. ORANGE PEELCAUSES:

- A. Paint applied too heavily.
- B. Improper thinner or reducer.
- C. Improper spray pattern.
- D. Insufficient reduction.
- E. Incorrect air pressure.

TO PREVENT:

- A. Apply in accordance with label directions.
- B. Select proper thinner or reducer.

- C. Be sure spray pattern is properly set. Use spray gun air cap and nozzle for material being applied in accordance with equipment manufacturer's recommendations.
- D. Avoid under reduction. Thin in accordance with label directions. In extremely cold shops, material should be warmed slightly to lower the viscosity, avoiding the need to use excessive solvent.
- E. Use the air pressure as recommended for material being sprayed.

REMEDY:

A. Rub with rubbing compound after the finish has thoroughly dried. When orange peel is excessive, water sand with 500 or 600 grit paper to eliminate orange peel, then spray one or more coats as needed with a good quality thinner, and with a small amount of retarder added.

20. OVERSPRAY

CAUSES:

- A. Inferior thinner or reducer.
- B. Improper application.
- C. Too high air pressure.

TO PREVENT:

- A. Use the proper thinner or reducer.
- B. Apply in accordance with directions.
- C. Avoid excessively high air pressures. Follow recommendations for product being applied.

REMEDY:

If compounding will not remove overspray, sand with 400 or 600 grit paper and refinish.

21. PEELING



CAUSES:

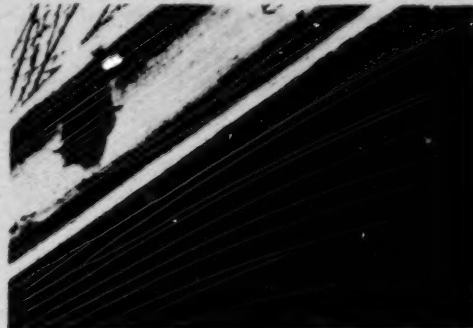
- A. Improper cleaning of the surface to be refinished.
- B. Wrong undercoat.
- C. Applying finishing materials over alloys without proper treatment.
- D. Poor grade of acrylic lacquer thinner or synthetic reducer.
- E. Application of undercoats to a cold surface.
- F. Presence of moisture on surface prior to application of finishing materials.

TO PREVENT:

- A. Clean the surface to be refinished thoroughly.
- B. Select the proper undercoat.
- C. Treat bare metal as recommended.
- D. Use proper thinner or reducer.
- E. Surface to be finished should be at least room temperature, preferably above 60°.
- F. Drain air regulator regularly. If wet sanding, permit the the surface to dry thoroughly before recoating.

REMEDY:

Remove the finish in the affected area to a point where you attain an excellent featheredge, then refinish.

22. PEELING GUTTERSCAUSES:

- A. Peeling or cracking of galvanized metal gutters, downspouts, etc.

- B. Improper metal primer or no primer used on galvanized metal results in a paint film with little or no adhesion.

TO PREVENT:

- A. Strip off all loose paint by scraper, wire brush, or, best of all, power wire brushing. It is very important that all loose paint be removed or succeeding coats of paint will subsequently peel away too.
- B. When finishing with an oil-base topcoat, prime bare metal with metal primer. When finishing with a latex topcoat, apply latex paint directly to bare galvanized areas after cleaning with a solvent. Allow solvent to evaporate.
- C. Finish with a topcoat of House-Paint. Use two (2) top coats when a color change is involved or substantial bare metal is exposed.

23. PITTING - PINHOLING



CAUSES:

- A. Presence of moisture.
- B. Undercoat applied too heavily; insufficient drying time between coats or under reduction, resulting in solvent being "trapped" in undercoat.
- C. Silicones on surface.

TO PREVENT:

- A. Be sure old finish is dry.
- B. Drain air regulator before spraying.
- C. Apply light or medium even coats with recommended reduction, allowing maximum drying time between coats.
- D. Remove silicone polish.

REMEDY:

Sand affected areas to a smooth finish and refinish.

24. REDWOOD AND CEDAR STAININGCAUSES:

A. Moisture in siding dissolves coloring matter in wood. Colored water escapes on to paint through breaks in the paint film and drips from underneath the overlapping board. Stain is deposited as water dries.

TO PREVENT:

- A. Locate and eliminate sources of moisture before painting.
- B. Wash stained surface with a mixture of 50% denatured alcohol and 50% clean water.
- C. Allow surface to dry 48 hours. Then apply two coats of recommended house paint according to label directions.

25. RUNS OR SAGS

CAUSES:

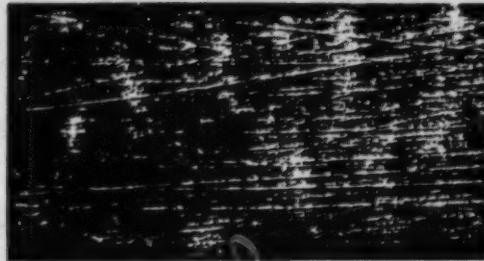
- A. Holding the spray gun too close to the surface and flooding or "piling on" materials.
- B. Improper reduction.
- C. Insufficient air pressure.
- D. Improper gun adjustment.
- E. Applying too much paint at one time.

TO PREVENT:

- A. Hold the gun the proper distance (6 to 12 inches) from the surface to be refinished. Avoid flooding or "piling on" heavy wet coats of material.
- B. Thin or reduce materials in accordance with label directions.
- C. Adjust air pressure in accordance with recommendations.

REMEDY:

Either wash off immediately or permit the film to dry thoroughly, then sand to remove runs and refinish.

26. SAND SCRATCHESCAUSES:

- A. Using coarse grit sandpaper.
- B. Improper cleaning of surface.
- C. Swelling of topcoat solvents.
- D. Improper preparation of surface.
- E. Undercoat applied too heavy.
- F. Use of wrong or poor quality thinner.

REMEDY:

- A. Sand surface smooth.
- B. Surface must be thoroughly cleaned.
- C. Applying recommended primer and sealer.
- D. Use proper thinners or reducers.

27. SLOW DRYINGCAUSES:

- A. Improper cleaning of old surface.
- B. Wrong thinner or reducer.
- C. Oil coming through from air compressor.
- D. Improper shop ventilation or heating.
- E. Too heavy application or insufficient dry time between coats.

F. A lack of a drier in Custom mixed Enamel colors.

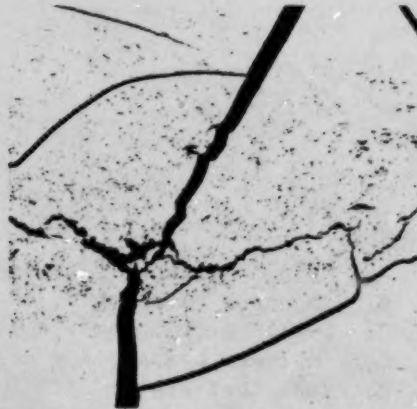
TO PREVENT:

- A. Clean and finish thoroughly.
- B. Use proper thinner or reducer.
- C. Check air compressor regularly for oil leaks.
- D. Drying time of synthetic enamels is materially affected at temperatures below 70°. Air must circulate through the shop to pull evaporating solvent away from paint surface.
- E. Apply in accordance with label directions.
- F. Add drier as listed in formula.

REMEDY:

Generally, if slow drying is caused by any of the above except "F", the paint film will ultimately harden sufficiently. A film which does not dry due to lack of drier should be removed and the surface refinished.

28. SPLITTING AND ALLIGATORING OF UNDERCOATS



CAUSES:

- A. First coat is applied too heavily.
- B. Material not thoroughly stirred.
- C. Oil leakage from compressor.
- D. Poor quality thinners, reducers, or undercoats.
- E. Insufficient dry time between coats.

TO PREVENT:

- A. Apply first coats thin and allow maximum dry time between coats.
- B. Stir material thoroughly.
- C. Check compressor regularly.
- D. Allow sufficient dry or flash time between coats.

REMEDY:

Sand the affected area to a point beyond the splitting, and prime again.

29. STREAKING (MOTTLING)CAUSES:

A. Usually occurs in metallic colors due to improper application.

TO PREVENT:

A. Apply in accordance with directions, being certain that material is properly thinned or reduced.

REMEDY:

Increase reduction and air pressure slightly. Hold gun back about 12 to 15 inches and "fog" coats over the affected areas until an even finish results.

30. TOP COAT PEELING

CAUSES:

- A. Usually found on overhanging horizontal surfaces and other areas protected from weather.
- B. Due to poor adhesion to previous coat of paint from build up of "salt" deposits which are not washed away by rain.

TO PREVENT:

- A. Sand surface thoroughly to remove all peeling paint.
- B. Wash sanded surface with solution of three heaping tablespoons (1/3 cup) powdered detergent to one gallon of water. Rinse well and allow to dry.
- C. Apply two coats of exterior wood undercoater, or one coat of undercoater and one top coat of a recommended house paint according to label directions.

31. TRANSPARENCYCAUSES:

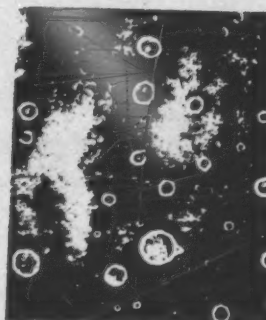
- A. Color not thoroughly stirred.
- B. Certain colors, by their very nature, have less hiding qualities, particularly true of maroons or dark blues.
- C. Material is too thin.

TO PREVENT:

- A. Stir material thoroughly. Be sure all pigment is in solution.
- B. Use ground coat to provide solid background.
- C. Avoid over reduction in applying initial coats of color.

REMEDY:

Use ground coat to obtain solid background. Avoid over reduction.

32. WATER SPOTTINGCAUSES:

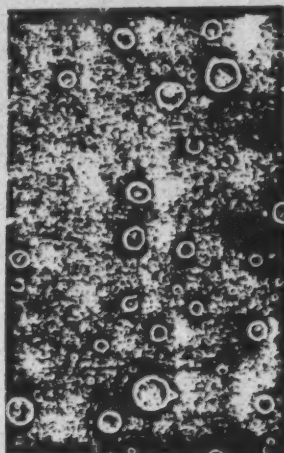
- A. Exposing the finish to rain or moisture before the film is thoroughly dry.

TO PREVENT:

- A. New finish must be thoroughly dry before exposing it to rain or moisture.

REMEDY:

If discoloration or spotting can't be removed by compounding, then sand and refinish.

33. WET SPOTSCAUSES:

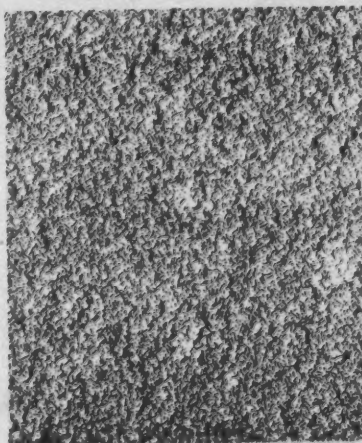
- A. Wax, grease, and oil remaining on old surface.
- B. Sanding with lead compounded gasoline.
- C. Cleaning with lead compounded gasoline.

TO PREVENT:

- A. Clean old finish thoroughly.
- B. Avoid gasoline in wet sanding.
- C. Avoid gasoline in cleaning.

REMEDY:

Remove finish in affected area and refinish.

34. WRINKLING

CAUSES:

- A. Excessive film thickness or "piling on" of heavy wet coats.
- B. Placing in hot sun too soon after spraying.
- C. Force-drying air dry enamels without the use of a baking converter.
- D. Improper enamel reducer.
- E. Using lacquer thinner to reduce synthetic enamels.
- F. Spraying under excessively hot humid weather conditions.

TO PREVENT:

- A. Avoid excessive film thickness and heavy coats. Allow sufficient dry time between coats.
- B. Keep away from direct sunlight until the finish has dried.
- C. Use the proper reducer.
- D. Use synthetic enamel reducers, not acrylic lacquer thinners, for best results in synthetic enamel, and to prevent wrinkling.

REMEDY:

Remove the wrinkled enamel and refinish.

REFERENCES:

1. Better Homes and Gardens Guide To Painting, Finishing, and Redecorating. Meredith Corp., 1970.
2. Farm Shop. Wakeman and McCoy, New York: The MacMillan Company, 1960.
3. A Guide To Better Automotive Refinishing. Martin Senour Paints, NAPA, 1974.
4. How To Spot'N Solve House Paint Problems. The Sherwin-Williams Company.
5. Pittsburgh-Paints - Product and Painting Guide. PPG Industries, Inc., 1974, Pittsburgh, Pennsylvania.

STUDENT ACTIVITIES:

1. Take a field trip to a run-down house in the area and recognize as many paint problems as possible.
2. Have a person (professional painter) come to the class to discuss painting problems and their solutions.
3. Have students do any experimental project along the following lines:
 - A. Each student prepares two (2) samples:
 - 1). one in which all precautions are observed in painting.
 - 2). one in which all solutions and precautions are disregarded and are used in the opposite way.
 - B. Each student then compares the two samples and observes the differences.
 - C. Each student records the results of his experiment on an overall class chart under each specific paint problem.

EVALUATION:

The evaluation for this problem area is left up to the instructor due to individual time and materials available.

Enterprise: Agricultural Mechanics

Unit: Paints and Preservatives

Problem Area: Operating and Using Power Spray Painting Equipment

Situation:

1. This is intended for high school students who have had little prior instruction on the operation and use of applying paint with power paint spraying equipment.

Teacher Objectives:

Upon completion of this problem area, the student will be able:

1. To correctly operate a power paint sprayer.
2. To correctly list the advantages and disadvantages of spray painting.
3. To obtain an adequate knowledge of spray painting for home and industrial use.

Teaching Procedure:

Motivation:

1. Show the students a sample of painting which has runs or sags.
ASK: What caused this? What is the proper way of spray painting?
2. Show the students a power spraying unit.
Briefly demonstrate how it is used. Ask one student to operate the gun.
ASK: What is the proper way to hold the spray gun?
3. Show the students two surfaces to be painted: one rough one and a smooth surface.
ASK: Which surface would you most likely use a sprayer on? Why?

Student Objectives:

Upon completion of this problem area, the student will be able:

1. To correctly list the three (3) main types of spray guns.
2. To correctly demonstrate how a power paint sprayer is used on a practical test.
3. To correctly list several advantages and disadvantages of spray painting.
4. To correctly list some of the specifications of an OSHA - approved paint room.
5. To correctly identify the proper procedures for cleaning a power paint sprayer.
6. To correctly list several safety factors to be observed during the spraying process.

Technical Information:

More and more people are realizing the importance and convenience of power spray painting. It will be the purpose of this presentation to acquaint you with the knowledge, skills, appreciations, and attitudes that are necessary to obtain an upstanding and quality paint job.

Before any power paint spraying can be done there must be adequate equipment to use. The basic equipment required for a power paint sprayer is:

1. Compressor
2. Air regulator - air hose
3. Spray gun

I. Compressor - Careful selection of the air compressor is vitally important. It must have capacity at least equal to all the tools that it may operate. For example, an air sander needs 7.5 cubic feet per minute, a production type spray gun needs 8.5 C.F.M., and a touch-up spray gun needs 2.5 C.F.M. -- all of this equals a total of 18.5 C.F.M.

II. Air regulator - air hose

- A. The oil and water extractor (air regulator) should be at least 25 FEET from the compressor or farther if possible. Air lines must be at least 25 feet or more because the temperature of the air is greatly increased as it passes through the compressor. This compressed air must be cooled before the moisture in it will condense. If the air from the compressor is still warm when it passes through the oil and water extractor, moisture will not be effectively removed, but will remain in suspension. Then, when the air cools in the hose beyond the extractor, the moisture will condense into drops of water and cause trouble such as blistering and spotting.
- B. All lines must be properly drained. Pitch all air lines back towards the compressor so that condensed moisture will flow back into the air receiver where it can be removed by opening a drain. Every low point on an air line acts as a water trap. Such points should be fitted with an easily accessible drain. (See Transparency Master #I)
- C. The standard hose for spray gun use is 5/16" in diameter. A smaller hose will cause a greater drop in air pressure between the air supply and the spray gun. For example, with 5/16" there is 5 pounds loss in air pressure for every 25' of hose -- with 1/4" hose there is 16 pounds loss for every 25' of hose.

III. Spray Gun

Select good quality spray guns for a QUALITY JOB.

If you have only one spray gun, use two heads, one for lacquer and the other for enamel. BE SURE to clean the gun thoroughly when switching from one product to another.

A. TYPES OF SPRAY GUNS

1. Siphon feed - these are more widely accepted and preferred by many experienced, top-notch painters.

HOW IT WORKS: The air pressure passing over the opening in the fluid nozzle creates a suction or "siphon" that draws the material up from the cup, and out the nozzle.

2. Pressure - The material is forced out of the cup and through the nozzle by air pressure.

3. Airless Spray -

- a. Principle employed can be compared to getting a fine spray from a garden hose nozzle turned to near closed position with water pressure full on.
- b. The paint is subjected to tremendously high pressure by a self contained pump.
- c. The paint passes from the pump discharge, through a small inside diameter hose, to a simple, light-weight spray gun.
- d. Trigger activation releases the paint, completely atomized, through a small elliptical orbit in the nozzle.
- e. The gun requires no air connection and has no adjusting screws.
- f. Fan angles and material quantities are determined by selection of different atomizing tips.
- g. Advantages of Airless Spray:
 - 1) Smaller units are completely portable.
 - 2) More paint can be applied.
 - 3) It is faster.
 - 4) Overspray is kept to a minimum.
- h. Disadvantages of Airless Spray:
 - 1) Film thickness is difficult to control resulting in runs and sags on contoured surfaces.
 - 2) It is difficult to attain quality finishes with automotive enamels, acrylic enamels, and acrylics.
 - 3) Airless Spraying is not economical unless a large quantity of a single color is used.
- i. Overall, airless spraying is practical on farm machinery, over-the-road trailers, or any object that does not require a high quality automotive finish and where substantial gallongage of one color will be used.

THE SPRAYING PROCESS

The first requirement for a good resultant paint finish is the proper handling of the spray gun.

The point on the spray gun where the paint and air escape is called the air cap which has three holes in it.

- a. One (1) central hole which breaks up or atomizes the fluid or paint.
- b. Two (2) outer holes from which air flows to form the atomized fluid into a definite pattern.
 - 1) round pattern - when air passes through the center hole only.
 - 2) fan pattern - when air passes through all three holes. (Most sprays have fan patterns only.)

THE PROCEDURE USED IN SPRAYING

- A. Assemble moisture extractor and gun.
- B. Check all connections and adjust to proper pressure. REMEMBER: Air pressure drops as the line gets longer. The proper pressure will be that which is required by the sprayer manufacturing company.
- C. Prepare the paint.
 1. Thin the paint or fluid as prescribed by the manufacturer.
 2. Strain all material, that is to be sprayed, through cheese cloth.
 3. Pour paint into spray cup.
- D. The use of the spray gun.
 1. Adjust the gun for the proper spray pattern.
 - a. A small spray pattern for spot repair and a large pattern for large areas.
 - b. The pattern is made by holding the gun 6 - 12 inches from a piece of cardboard and adjusting for desired pattern. (See Transparency Master #2)
 2.
 - a. The gun should be held perpendicular to the surface being covered, and moved in even strokes parallel with it, not in an arc.
 - b. The stroke should be started before the trigger is pulled and released before the stroke is finished. This is easy and gives accurate control of the gun and the material.
 - c. The distance the gun is held from the surface being covered is determined by the material and atomizing pressure.
 - d. This distance will vary from 6 to 12 inches, but the material deposited should always be even and wet.
 - e. Lap each stroke over the proceeding stroke to obtain a uniform finish. (See Transparency Master #3).
 3. Gunning corners:
 - a. Outside Corners - Shoot squarely on the outside corners. This deposits a heavy coat on corners where it is needed and is obtained by adjusting the air cap for a horizontal fan.
 - b. Inside Corners - The correct way is to spray each corner in turn. Do not shoot squarely on inside corners as it causes excessive paint build-up and uneven coats that may

run or sag.

*NOTE: Do not allow overspray to hit dry surfaces as it will dull the finish.

4. Cleaning the Spray Gun:

Cleaning Pointers:

- a. When used with a cup, a thinner or a suitable solvent should be siphoned through the gun by inserting in an open container of that liquid.
- b. Move the trigger constantly to thoroughly flush passageway and to clean the tip of the needle.
- c. Cleaning the gun used with a pressure tank:
 - 1) Shut off the air supply to the tank and release the pressure on the tank.
 - 2) Open the vent and loosen the air nozzle.
 - 3) Hold a piece of cloth, wadded in your hand, over the nozzle and pull the trigger.
 - 4) The air will back up through the fluid nozzle and force the fluid out of the hose into the tank.
 - 5) Put enough thinner into the tank to wash the hose and gun thoroughly and spray this through the gun until it is clean.
 - 6) Blow out the fluid hose to dry it and remove all traces of materials by attaching it to the air line.
- d. Always keep the thinner level below the packing of the spray gun.
- e. It is a POOR practice to place an entire gun in thinner. When this is done, the solvent dissolves the oil in the leather packing and causes the gun to spit.
- f. It is a GOOD practice to place the nozzle and fluid connection in thinner. The vessel used should be shallow enough to prevent thinner from reaching the packing.
- g. Oil the fluid needle packing, air valve packing, and trigger bearing screw frequently.
- h. Occasionally coat the needle valve spring with petroleum jelly.
- i. Overall, OIL ALL WORKING PARTS EVERY time they are used.

PROBLEMS ENCOUNTERED IN SPRAYING AND HOW TO OVERCOME THEM

Refer To Transparency Master #4 and the Following Technical Information

PROBLEM	POSSIBLE CAUSES	SOLUTIONS
Sags	1. Dirty air nozzle and material nozzle (distorted spray pattern). 2. Gun stroked too close to the surface. 3. Trigger not released at end of stroke. 4. Gun stroked at wrong angle to surface. 5. Paint piles on too heavy. 6. Paint thinned out too much.	1. Remove air nozzle and clean all nozzles carefully. 2. Stroke the gun 6" to 12" from the surface. 3. Operator should release the trigger after every stroke. 4. Gun should be stroked at right angle to the surface. 5. Learn how to calculate depth of wet film of paint. 6. Add the correct amount of solvent by measure.
Streaks	1. Dirty air nozzle and material nozzle. 2. Insufficient or incorrect overlapping of strokes. 3. Gun stroked too rapidly. 4. Gun stroked at wrong angle to surface. 5. Stroking too far from surface. 6. Too much air pressure 7. Split spray.	1. Remove air nozzle and clean material and air nozzle carefully. 2. Follow the previous strokes accurately. 3. Avoid whipping of gun. 4. Gun should be stroked at right angles to surface. 5. Stroke 6" to 12" from surface. 6. Use least air pressure that is necessary. 7. Reduce fan adjustment or change air nozzle.
"Orange Peel"	1. Paint not thinned out sufficiently. 2. Not depositing a wet coat.	1. Add the correct amount of solvent by measure. 2. Check solvent. Use correct speed and overlap of stroke.

PROBLEM	POSSIBLE CAUSES	SOLUTIONS
"Orange Peel" (continued)	3. Gun stroked too rapidly ("dusting" the paint). 4. Insufficient air pressure. 5. Using wrong air nozzle. 6. Gun stroked too far from the surface. 7. Overspray striking a previously sprayed surface.	3. Avoid "whipping". Take deliberate slow strokes. 4. Increase air pressure or reduce fluid pressure. 5. Select correct air nozzle for the material and feed. 6. Stroke the gun 6" to 12" from the surface. 7. Spray detail parts first. End with a wet coat.
Excessive Spray Fog	1. Too high air pressure. 2. Spraying past surface of the product. 3. Wrong air nozzle or material nozzle. 4. Gun stroked too far from the surface. 5. Material thinned out too much.	1. Use least amount of compressed air necessary. 2. Release trigger when gun passes target. 3. Ascertain and use correct setup. 4. Stroke the gun 6" to 12" from the surface. 5. Add the correct amount of solvent by measure.
Excessive Paint Loss	1. Not "triggering" the gun at each stroke. 2. Stroking at wrong angle of surface. 3. Stroking gun too far from the surface. 4. Wrong air nozzle or material nozzle. 5. Depositing a paint film of irregular thickness. 6. Air pressure too high.	1. It should be a habit to release the trigger after every stroke. 2. Gun should be stroked at right angles to surface. 3. Stroke the gun 6" to 12" from the surface. 4. Ascertain and use correct setup. 5. Learn to calculate the depth of a wet film finish. 6. Use the least amount of air necessary.

PROBLEM	POSSIBLE CAUSES	SOLUTIONS
Excessive Paint Loss (continued)	7. Fluid pressure too high.	7. Reduce pressure. If pressure keeps climbing, clean regulator on pressure tank.
Paint Won't Come From Spray Gun	1. Out of paint (gun begins to sputter). 2. Grit, dirt, paint, skins, etc. blocking gun tip, fluid valve or strainer.	1. Add paint that is correctly thinned out and strained. 2. Clean your spray gun thoroughly and strain the paint. Always strain the paint before using it.
Paint Won't Come From Pressure Tank	1. Lack of proper air pressure in the pressure tank. 2. Air intake opening, inside of pressure tank lid, clogged by dried-up paint. 3. Leaking gasket on tank cover.	1. Check for leaks or lack of air entry. Adjust air pressure for sufficient flow. 2. This is a common trouble. Clean the opening periodically. 3. Replace with a new gasket.
Paint Won't Come From Suction Cup	1. Dirty material nozzle and air nozzle. 2. Clogged air vent on cup cover. 3. You may be using the wrong air nozzle. 4. Leaky connections on fluid tube or nozzle.	1. Remove air nozzle and clean material nozzle and air nozzle carefully. 2. Remove the obstruction. 3. Ascertain and use correct setup. 4. Check for leaks under water and then repair.
Gun Sputters Constantly	1. Material nozzle not tightened to spray gun. 2. Leaky connection on fluid tube or needle packing (suction gun)	1. Tighten securely using a good gasket. 2. Tighten connections and lubricate packing.

PROBLEM	POSSIBLE CAUSES	SOLUTIONS
Gun Sputters Constantly (continued)	3. Fluid pipe not tightened to the pressure tank lid.	3. Tighten and check for defective threads.
Paint Leaks from Spray Gun	1. Material needs packing not too tight. 2. Packing for material needle dry. 3. Foreign particle blocks fluid tip. 4. Damaged material nozzle or needle.	1. Loosen nut and lubricate packing. 2. Lubricate this part daily. 3. Remove tip and clean. 4. Replace both tip and needle.

ADJUSTMENT OF THE SPRAY GUN FOR SPRAYING

- A. SIPHON SPRAYING- Set the atomization pressure at approximately 50 lbs. for lacquer and 60 lbs. for enamel. Test the spray. If the spray is too fine, reduce the air pressure or open fluid control screw. If the spray is too coarse, close the fluid control screw. Adjust the pattern width and repeat adjustment of spray if necessary.
- B. PRESSURE SPRAYING - After selecting the correct size fluid orifice, set the fluid pressure for the desired flow. Open the atomization air and test spray. If the spray is too fine reduce the air pressure. If the spray is too coarse, raise the air pressure. Adjust to the desired pattern width and repeat the adjustment of the spray. Keeping the fluid control screw in the open position will reduce the wear on the fluid needle.

"OSHA APPROVED" SPRAY PAINTING ROOM

Often a teacher or individual is unaware of most of the standards that the Occupational Safety and Health Administration has set for the conventional spray painting room. When plans are being made for new construction or remodeling, it would be wise to include as many of the following requirements as could be deemed necessary - both practically and economically. (See Transparency #5)

The following is a very brief OSHA explanation of those safety features required during Spray Finishing using flammable and combustible materials. For an in depth explanation, please refer to Federal Register - Part II, Department of Labor. Occupational Safety and Health Administration, pp. 10546 - 10553.

DEFINITIONS:

Spraying area - Any area in which dangerous quantities of flammable vapors or mists, or combustible residues, dusts, or deposits are present due to the operation of spraying processes.

Spray Booth - A power - ventilated structure provided to enclose or accommodate a spraying operation to confine and limit the escape of spray, vapor, and residue, and to safely conduct or direct them to an exhaust system.

Approved- Shall mean approved and listed by the following nationally recognized testing laboratories:

1. Underwriters Laboratories, Inc.
2. Factory Mutual Engineering Corp.

THE CONSTRUCTION OF SPRAY BOOTHS

1. Construction - Spray booths shall be substantially constructed of steel not thinner than No. 18 U.S. gauge, securely and rigidly supported, or of concrete or masonry, except that aluminum or other substantial noncombustible material may be used for intermittent or low volume spraying. Spray booths shall be designed to sweep air currents toward the exhaust outlet.
2. Interior - The interior surfaces of spray booths shall be smooth and continuous without edges and otherwise designed to prevent pocketing of residues and facilitate the safe cleaning and washing without injury.
3. Floors - The floor surface of a spray booth and operating working area, if combustible, shall be covered with non-combustible material of such character as to facilitate the safe cleaning and removal of residues.

4. Distribution or baffle plates - These plates, if installed to promote an even flow of air through the booth or cause the deposit of overspray before it enters the exhaust duct, shall be of noncombustible material and readily removable or accessible on both sides for cleaning. Such plates shall not be located in exhaust ducts.
5. Dry type overspray collectors (exhaust air filters) - The spraying operations shall be so designed, installed, and maintained that the average air velocity over the open face of the booth (or booth cross-section during spraying operations) shall be not less than 100 linear feet per minute.
6. Frontal area - Each spray booth having a frontal area larger than 9 square feet shall have a metal deflector or curtain not less than 2 1/2 inches deep installed at the upper outer edge of the booth over the opening.
7. Separation of Operations - Each spray booth shall be separated from other operations by not less than 3 feet, or by a greater distance, or by such a partition as a wall so as to reduce the danger from the formation of hazardous operations.
8. Cleaning - Spray booths shall be so installed that all portions are readily accessible for cleaning. A clear space of not less than three feet on all sides shall be kept free from storage or combustible construction.
9. Illumination - When spraying areas are illuminated through glass panels or other transparent materials, only fixed lighting units shall be used as a source of illumination. Panels shall effectively isolate the spraying area from the area in which the lighting unit is located, and shall be of non-combustible material of such a nature or so protected that breakage will be unlikely.
10. Electrical Wiring - Electrical wiring and equipment not subject to deposits of combustible residues but located in a spraying area as herein defined shall be of explosion-proof type.
11. Grounding - All metal parts of spray booths, exhaust ducts, and piping systems conveying flammable or combustible liquids or aerated solids shall be properly grounded electrically in an effective and permanent manner.
12. Ventilation - All spraying areas shall be provided with mechanical ventilation adequate to remove flammable vapors, mists, or powders to a safe location and to confine and control combustible residues so that life or property is not endangered. Mechanical ventilation shall be kept in operation at all times while spraying operations are being conducted and for a sufficient time thereafter to allow vapors from drying coated articles and drying finishing material residue to be exhausted.

13. Storage of flammable and combustible material - The quantity of flammable or combustible liquids kept in the vicinity of spraying operations shall be the minimum required for operations and should ordinarily not exceed a supply for 1 day or 1 shift. Bulk storage or portable containers of flammable or combustible liquids shall be in a separate, constructed building detached from other important buildings.
14. Containers - Original closed containers, approved portable tanks, approved safety cans or a properly arranged system of piping shall be used for bringing flammable or combustible liquids into a spraying area. Open or glass containers shall not be used.
15. Extinguishers - An adequate supply of suitable portable fire extinguishers shall be installed near all spraying area.

OPERATIONS AND MAINTENANCE:

16. Spraying - Spraying shall not be conducted outside of predetermined spraying areas.
17. Cleaning - All spraying areas shall be kept as free from the accumulation of deposits of combustible residues as practical, with cleaning conducted daily if necessary. Scrapers, spuds, or other such tools used in cleaning shall be of nonsparking material.
18. Residue disposal - Residue scrapings and debris contaminated with residue shall be immediately removed from the premises and properly disposed of. Approved metal waste cans shall be provided wherever rags or wastes are covered with finishing material. The contents of the waste cans shall be properly disposed of at least once daily or more often.
19. Clothing Storage - Spray painters' clothing shall not be left on the premises overnight unless kept in metal lockers.
20. Cleaning Solvents - The use of solvents for cleaning purposes shall be restricted to those having flashpoints not less than 100° F. However, for cleaning spray nozzles and auxiliary equipment, solvents having flashpoints not less than those normally used in spray operations may be used. Such cleaning shall be conducted inside spray booths and ventilating equipment operating during cleaning.
21. "No Smoking" Signs - "No Smoking" signs in large letters on contrasting color background shall be conspicuously posted at all spraying areas and paint storage rooms.
22. Fire protection - All areas used for spraying, including the interior of the booth, shall be protected by automatic sprinklers where this protection is available. Where this protection is not available, other approved automatic extinguishing equipment shall be provided.

23. Respirators - The proper respirators should be used in order to insure the air being breathed is not of a toxic level. The type of respirator would depend upon the material used in spraying and the conditions under which it is used.

These have been some brief standards that OSHA has set up for spray painting areas. As stated previously, these are only a few of the minimum qualifications so set forth.

Now that you have seen how basic spray painting is done, let us list some advantages and disadvantages of spray painting.

ADVANTAGES:

1. Faster than brush or roller application.
2. Depending on the size of the job, spray painting can be cheaper than brush or roller applicators.

DISADVANTAGES:

1. The initial cost of spray equipment is higher than brush or roller.
2. Clean-up following spray painting is more extensive and time consuming.
3. More painting skill is required to spray paint.

SAFETY IN SPRAY PAINTING

1. Ventilation should be provided at all times while using the spray.
2. When spraying with materials other than water-mixed paints, the operator or operators should be protected by good respirators.
3. Be careful to make sure your equipment is cleaned and in proper condition.
4. Do your painting when the air is warm and dry for best results.
5. Don't apply one heavy coat, but apply two thin coats.
6. Be careful of the tools that you use which are under pressure.
7. Paint in an OSHA-approved spray painting room whenever possible.

References:

1. Ditzler Repaint Manual. Ditzler Automotive Finishes, PPG Industries, Inc. Detroit, Michigan, March, 1972.
2. Federal Register. Department of Labor - Occupational Safety and Health Administration, May 29, 1971.
3. A Guide to Better Automotive Refinishing. NAPA - Martin Senour Paints, 1973.
4. Operating Instructions For Binks Spray Guns. Binks Manufacturing Company, Chicago, Illinois.
5. Paint, Painting, and Finishing. Construction Specifications Institute, Inc., Washington 6, D.C. January, 1963.

6. Pittsburgh Paints Product and Painting Guide. PPG Industries, Inc. Pittsburgh, Pennsylvania. April, 1973.
7. Spray Painting Hints. Binks Manufacturing Company, Chicago 12.
8. Wood Finishing and Painting Made Easy. Ralph G. Waring, Bruer Publishing Company.

STUDENT ACTIVITIES:

1. Arrange for a student field trip to one or more of the following:
 - a. A local professional spraying service.
 - b. An OSHA - approved paint spraying shop.
2. Have a professional sprayer talk to the class on arts, skills, and problems in power paint spraying.
3. Arrange for students to participate individually in a power spray painting exercise.

Name _____

Date _____

Evaluation:

Operating and Using Power Spray Painting

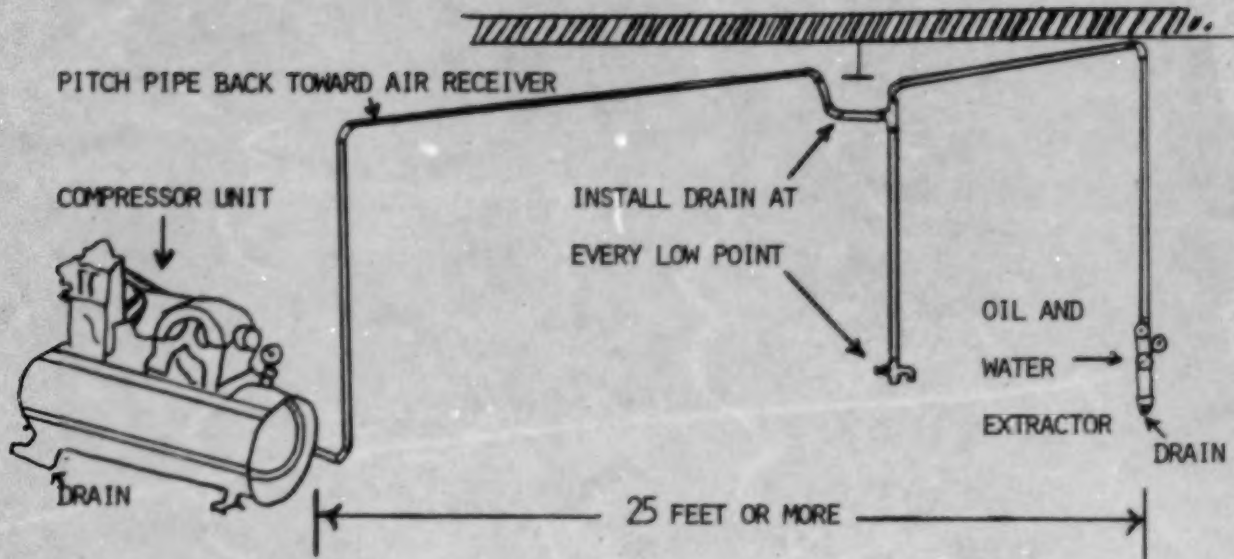
1. List two (2) advantages of spray painting.
 - a.
 - b.
2. List two (2) disadvantages of spray painting.
 - a.
 - b.
3. In outline form, briefly list some (at least 5) of the specifications of an OSHA-approved paint room.
 - a.
 - b.
 - c.
 - d.
 - e.
4. List several safety factors which should be observed during and after the spraying process.
 - a.
 - b.
 - c.
 - d.
5. True or False. The three main types of spray guns are: 1) Siphon Feed
2) Pressure; and 3) Forced Air spray.

MULTIPLE CHOICE:

6. The advantage of the airless spray is/are:
 - a. Smaller units are completely portable
 - b. It is faster
 - c. More paint can be applied
 - d. All of the above
7. Completion: Airless Spraying is not economical unless a large
_____ of a single color is used.
8. How many holes are in the air cap? What is the differences in their purposes?
9. True or False: Air pressure rises or increases as the paint line gets longer.

10. All material that is to be sprayed, is first strained through
_____.
11. Briefly describe how the spray gun is held during the spraying process. Include the angle, distance, "triggering", strokes, and lapping.
12. Now each student will demonstrate on a practical test how to spray the objects on the laboratory table. After this, please list the proper procedures for cleaning the sprayer here.

SUGGESTED INSTALLATION OF AN AIR COMPRESSOR AND AN OIL AND WATER EXTRACTOR



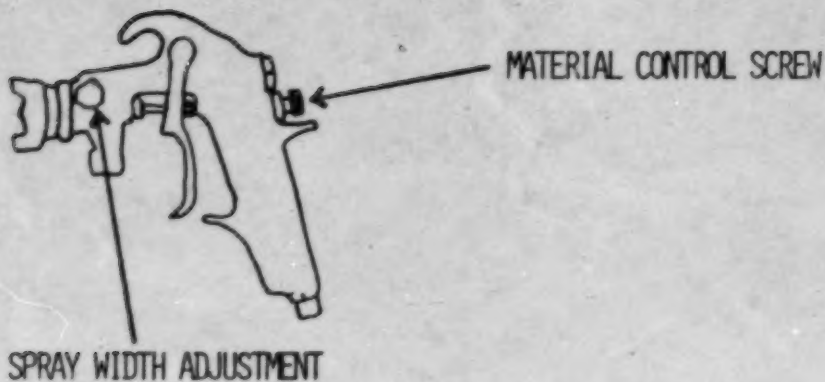
PIPE SIZE

VOLUME AIR C.F.M.	LENGTH OF PIPE IN FEET			
	50	100	150	200
10	1/2"	3/4"	3/4"	3/4"
20	3/4"	3/4"	3/4"	3/4"
30	3/4"	3/4"	1"	1"
40	1"	1"	1"	1"
50	1"	1"	1"	1"
70	1"	1"	1 1/4"	1 1/4"

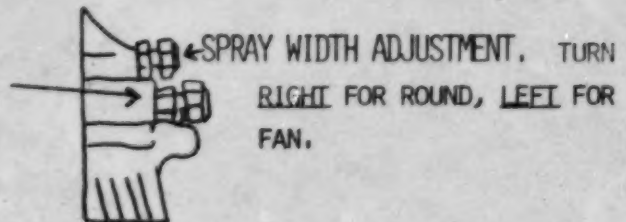
OIL AND WATER EXTRACTOR SHOULD BE AT LEAST 25 FT. FROM THE COMPRESSOR.

T - 1

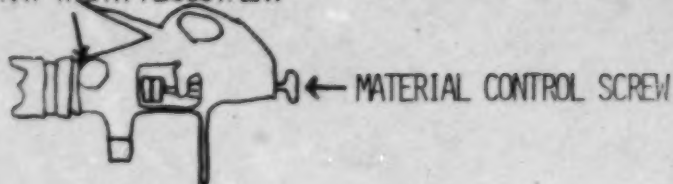
ADJUSTING THE SPRAY GUN



FLUID CONTROL SCREW. TURN RIGHT
TO DECREASE FLOW, LEFT TO INCREASE.

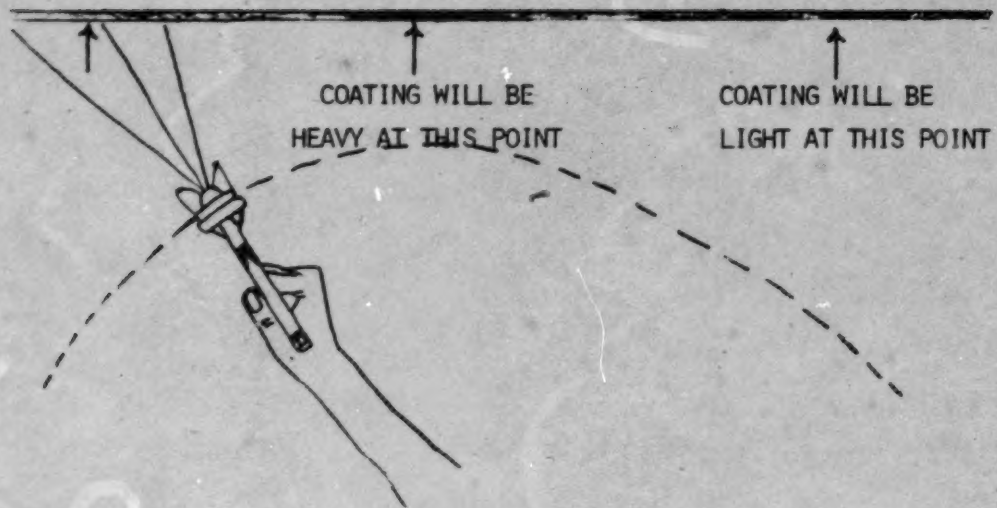


SPRAY WIDTH ADJUSTMENT

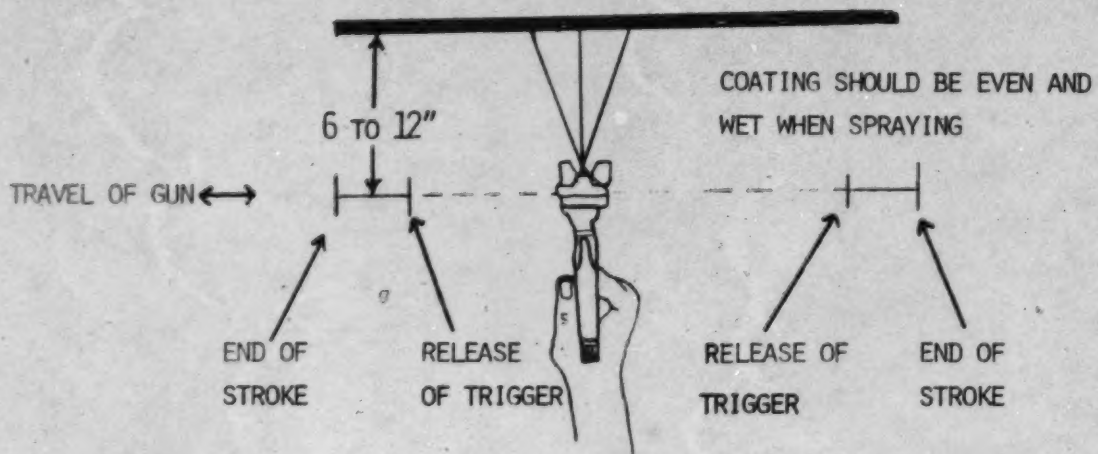


AS WIDTH OF SPRAY IS INCREASED, MORE MATERIAL MUST BE ALLOWED TO PASS
THROUGH THE GUN TO GET THE SAME COVERAGE ON THE INCREASED AREA.

HOLDING THE SPRAY GUN



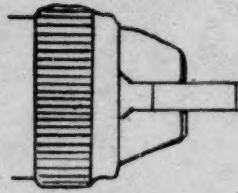
WRONG



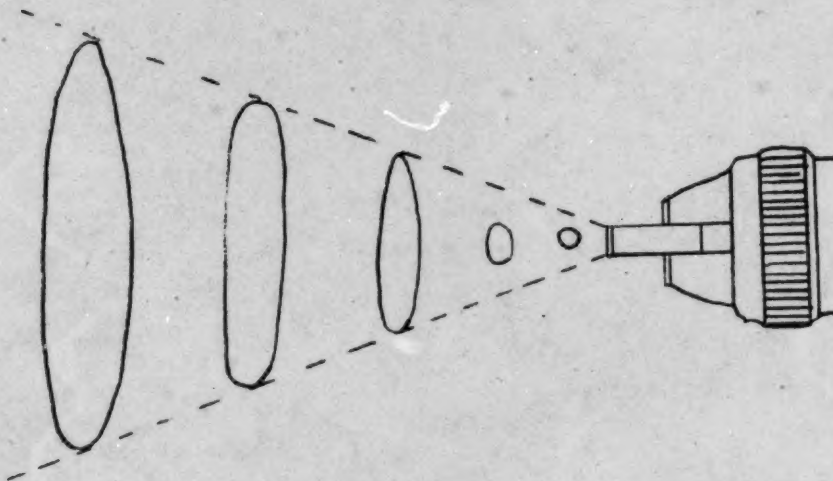
RIGHT

T - 3a

THE SPRAY PATTERN

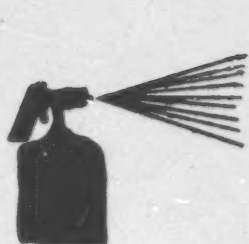


IN NORMAL OPERATION, THE WINGS ON THE NOZZLE ARE HORIZONTAL AS ILLUSTRATED HERE. THIS PROVIDES A VERTICAL FAN SHAPED PATTERN WHICH GIVES MAXIMUM COVERAGE AS THE GUN IS MOVED BACK AND FORTH PARALLEL TO THE SURFACE BEING FINISHED.



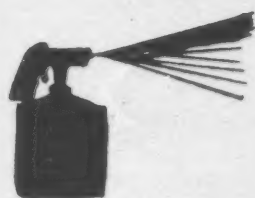
THE SPRAY PATTERN OF A SPRAY GUN IS VARIABLE FROM ROUND TO FLAT WITH ALL PATTERNS IN BETWEEN.

CAUSES OF IMPROPER SPRAY GUN OPERATION



THE PROPER ADJUSTED SPRAY PATTERN

- A. AN ELONGATED ELLIPSE.
- B. UNIFORM DISTRIBUTION OF MATERIAL.
- C. EVEN LAYER ALL OVER.



OUT OF BALANCE SPRAY

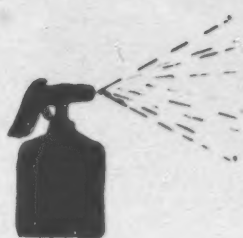
- A. DRIED MATERIAL IN OR ON FLUID NOZZLE.
- B. JETS IN AIR NOZZLE MAY BE PARTIALLY PLUGGED.
- C. WORN OR IMPERFECT NOZZLE OR NEEDLE.



SPLIT SPRAY

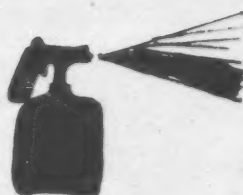
- A. SPLIT SPRAY REFERS TO A FAN PATTERN THAT IS HEAVY ON EACH END AND WEAK IN THE CENTER. AIR PRESSURE IS TOO GREAT.
- B. MATERIAL TOO THIN FOR WIDE SPRAY PATTERN.

CAUSES OF IMPROPER SPRAY GUN OPERATION



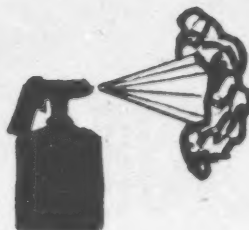
CURVED SPRAY PATTERN

- A. ONE AIR NOZZLE HOLE CLOGGED.
- B. AIR NOZZLE WORN.



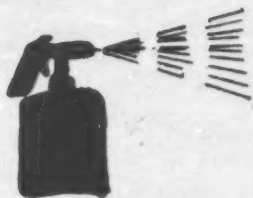
HEAVY END SPRAY PATTERN

- A. ATOMIZING PRESSURE IS NOT HIGH ENOUGH.



EXCESS OVERSPRAY

- A. EXCESSIVE AIR PRESSURE IN PROPORTION TO WEIGHT OF MATERIAL.
- B. MATERIAL IS TOO THIN.
- C. GUN IS NOT CLOSE ENOUGH TO THE SURFACE BEING REFINISHED.

CAUSES OF IMPROPER SPRAY GUN OPERATION

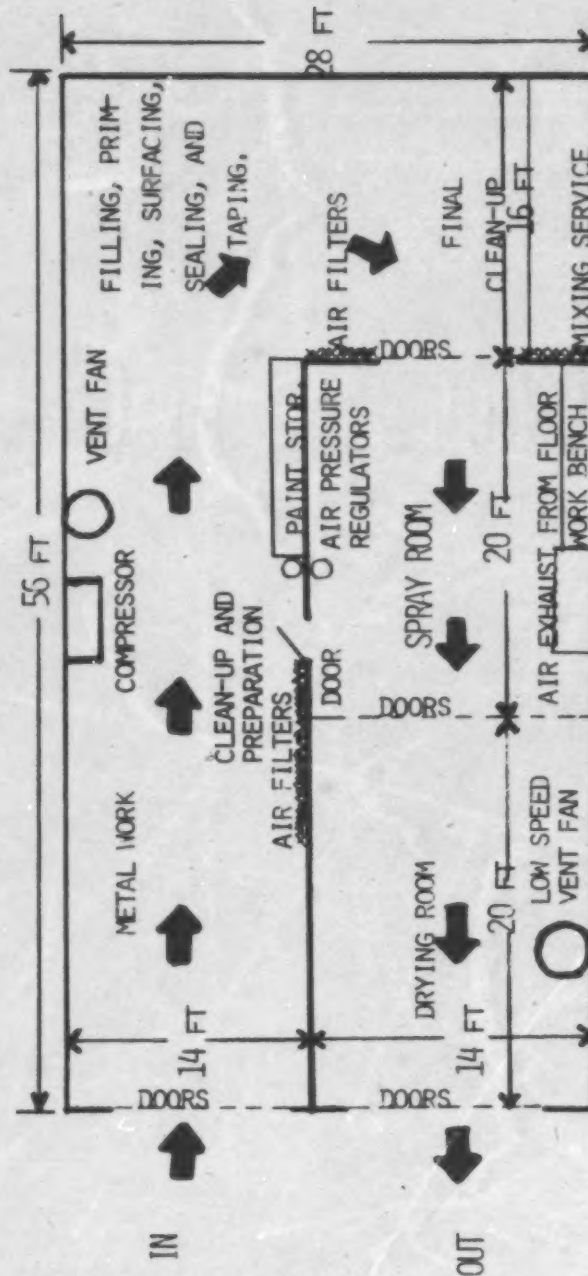
SPITTING

- A. VENT HOLE IN COVER MAY BE CLOGGED.
- B. FLUID NOZZLE WORN OR CRACKED. DIRT BETWEEN FLUID NOZZLE SEAT AND BODY.
- C. LOOSE OR DEFECTIVE SWIVEL NUT ON SIPHON CUP OR MATERIAL HOSE.
- D. LOOSE FLUID TUBE.

DRY DULL FINISH

- A. INSUFFICIENT COMPRESSOR CAPACITY.
- B. PRESSURE DROP DUE TO LINE FRICTION OBSTRUCTION OR LEAKS CAUSED BY BADLY WORN HOSE.
- C. VENT HOLE IN COVER IS CLOGGED.
- D. AIR CONTROL VALVE IS PARTIALLY CLOSED.

SHOP LAYOUT



THE SHOP LAYOUT, ILLUSTRATED ABOVE, IS NOT PRESENTED AS AN IDEAL ARRANGEMENT BUT AS AN EXAMPLE OF SOME OF THE THINGS MOST NECESSARY TO INCLUDE WHEN VERY LIMITED ROOM IS AVAILABLE.

Glossary of Common Painting Terms

You must be knowledgeable of the materials on labels and the relative money and use value of such ingredients. At the same time you must be able to interpret the instructions on the container. The following terms are listed for your understanding so that the printed information on paint and preservation containers will be more meaningful.

Absorption - The act of taking up, or assimilation, of one substance by another. Not to be confused with adsorption, which is a surface condition.

Accelerated Weathering - a laboratory method for simulating and accelerating the destructive effects of natural weather on paint films by exposing them to controlled light, temperature, humidity, water spray, and other artificial weather conditions.

Acetates - a group of organic solvents made by combining various alcohols with acetic acids such as ethyl acetates.

Acetic Acid - a sour organic liquid such as vinegar.

Acrylic - a type of later base water emulsion paints.

Acrylic Resins - water - white flexible, thermo-plastic made by polymerizing esters of acrylic acid.

Acrylic Resinis - a synthetic resin made from acrylic acids.

Adhesion - the property that causes one substance to bond to another.

Agglomeration - the condition in which particles of pigments collect in groups forming larger particles.

Agitator - any mixing device; a stirrer.

Air Drying - a coating material is called air drying when it is capable of drying hard at ordinary room temperature.

Airless Spray - A paint application device that atomizes paint via hydraulic pressure instead of a stream of air.

Alkali - a substance which neutralizes acids, forming a salt and water. Sodium hydroxide are common examples.

Alkyd Resins - a synthetic resin usually made of glycerol and fatty oils or fatty acids from vegetable oils. It is widely used as a paint vehicle.

Alligatoring - cracking of a paint film in a pattern resembling the appearance of alligator hide.

Amide Resins - resins containing the amide group - usually polyamides of fatty acid derivatives.

Anhydrous - Dry; zero water content. Especially water of crystallization.

Anodic Treatment - a treatment of metal, especially aluminum and magnesium, in which an adherent layer is formed on the surface by electrolysis. This layer is more corrosive - resistant and more receptive of paint than the metal itself.

Anti-Fouling - The property of a marine paint containing ingredients which are toxic to and prevent the attachment of barnacles and other marine growth to ship bottoms.

Aromatic Hydrocarbons - Hydrocarbons derived from or characterized by the presence of the benzene ring, such as benzene and toluence and xylene (also called Benzol, Toluol, and Xylol).

Atomize - To break up a liquid into fine particles producing a mist.

Baking or Baking Finish - a protective coating that requires baking at temperatures above 150 degrees Farenheit.

Binder - that portion of paint that forms a continuous film. It binds the pigment particles together.

Bleeding - The diffusing of coloring matter through a coating from the substrate or previous layers; also the discoloration resulting from such diffusion.

Blistering - The formation of bubbles in a dry paint film.

Blooming - The depositing of a thin film of foreign material on a paint film to produce a bluish florescent appearance.

Body - a term describing the viscosity or consistency of a paint.

Bonderizing - a chemical process for producing a phosphate coating on iron, steel or zinc surfaces as a rust inhibiting base for paint.

Boxing - a method for mixing paint in which the liquid is repeatedly poured from one container to another to attain uniform mixing.

Bridging - The covering of a crack in the substrate by a paint film.

Brittleness - the property of being inelastic, easily cracked.

Bronzing - an iridescent film on the surface of a paint coating. (See also BLOOMING).

Bubbling - Formation of bubbles in a drying paint film.

Calcimine - a mixture of water, calcuim carbonate, and glue.

Capillarity - The action by which the surface of a liquid is drawn up within narrow passages; the mechanism by which liquids rise in wicks and other porous materials.

Casein - the protein of milk which is used to bind the pigments of some water paints such as white wash.

Catalyst - a substance which, by its presence, changes the rate of a chemical reaction without being changed chemically. Usually a catalyst is employed in relatively small amounts.

Chalking - the process in the aging of a paint film which is characterized by the appearance of finely divided loose powder on the surface.

Checking - A kind of paint failure in which many small cracks appear on the film surface without exposing the surface under the film.

Chipping - the type of aging of a paint film characterized by the separation of the paint from the underlying substrate in flakes or chips.

Chlorinated Rubber - a synthetic resin made by the chemical reaction of chlorine with natural rubber.

Cloudiness - a condition in transparent liquids when they have a cloudy appearance.

Coating - a general term for paints, varnishes, and lacquers.

Color - the aspect of the appearance of objects which depends upon the composition of light reaching the eye.

Color Retention - The ability of a coating film to keep its original color unchanged with the passing of time without fading or discoloring.

Concentration - the amount of a component of a substance related to the whole substance.

Corrosion - the destruction of a metal by chemical or electrochemical reaction with its enviroment.

Corresion Fatigue - the reduction of fatigue durability by a corrosive environment.

Cost Per Square Foot Per Year of Protection - a reference used in the paint industry to scientifically compare the cost of a square foot of painted area over a period of one year or a number of years.

It is found by adding all paint costs - including preparation, labor, and paint - and dividing this sum into the total number of years of protection before the surfaces requires repainting to find the cost per square foot per year of protection.

Covering Power or Milage - the expression in square feet per gallon, of the ability of a coating to cover a surface.

Cracking - the type of paint aging characterized by breaks in irregular lines wide enough to expose the underlying surface.

Crawling or Creeping - the tendency of some liquids to draw up into droups, globules, or -issed spots.

Crazing - fine lines or very small surface cracks on paints films.

Crocking - removal of color by abrasion or rubbing.

Cure - to harden a liquid coating material.

Damp - Moist but not wet; no outstanding water droplets.

Degreaser - a device or chemical used to remove all grease and oil from a surface.

Diluents - Liquids which are not in themselves solvents, but which may be used with an active solvent to compound paint reducers.

Dip coating - coating by immersing the object in a tank of coating and withdrawing it.

Drier - a composition which accelerates the drying of oil, paint, printing ink, or varnish. Driers are usually metallic compositions and are available in both solid and liquid forms.

Dry - the process by which a liquid coating is converted into a solid, non-tacky surface. Drying may take place by evaporation of a solvent as in lacquers, by oxidation or polymerization of an unsaturated compound, as with oils or varnishes, by catalytic reaction, as with epoxy resins, or by addition of water, as with portland cement paints and certain wrethane coatings.

Dry Film Thickness - the thickness of film left after the evaporation of solvent and other drying reactions. Dry film thickness is usually reported in mils (thousandths of an inch).

Drying Oil - an oil which possesses the property of readily taking up oxygen from the air and changing to a relatively hard, tough, elastic substance when exposed in a thin film to the air.

Dry Spray - a condition when the spray reaches the surface with insufficient solvent for it to flow and level properly.

Durability - The ability of a material to withstand the destructive agents with which it comes in contact.

Effloresce - to become covered with a whitish crust or fine white crystals due to the deposition of soluble salts during the evaporation of water. Bricks and masonry walls have a strong tendency to effloresce.

Elastic - the property of a substance which forces it to return to its original shape after distortion.

Emulsifier - a material when added to dissimilar materials, like oil or water will result in a stable solution. Most emulsifiers are derived from soaps of alkali sources.

Emulsion - a colloidal dispersion in which the dispersed particles are in a liquid state.

Emulsion Paint - a paint in which the vehicle is a binder in water emulsion. The binder may be oil, oleoresinous varnish, resin, or any other emulsifiable binder.

Enamel - a paint that is made with lacquer or varnish as the vehicle which is characterized by the ability to form an especially smooth film.

Epoxy Resins - it is a combination of resin and oil which are much more resistant to corrosion than alkyd resins. Epoxy resins are made by the reaction of epichlorohydrin and bisphenols derived from petroleum.

Erosion - The wearing away of a coating to expose the underlying surface.

Ester - an organic chemical substance containing carbon that is formed by combining an acid and an alcohol.

Extender or Inerts - a pigment used to reduce the cost of a paint or to add certain needed properties such as flattening, sanding, and holdout. Talc, calcium carbonate, china clay, and barytes are commonly used as extenders.

Exotherm - the generation of heat due to chemical reaction of curing agent and base after mixing.

Fastness - stability or resistance to change of color of pigments when exposed to light, alkali, or other influences.

Feather Edging - tapering the edge of a finish particularly before refinishing a scratch or chip.

Filler - a pigmented composition for filling the pores or irregularities in a surface prior to applying other finishes.

Film Thickness - the thickness of an applied coating usually expressed in mils (thousandth of an inch)

Flaking - a coating film failure in which pieces of the film separate from the substrate.

Flash Point - the temperature at which the vapor of a liquid will ignite when exposed to a flame in a specific testing apparatus.

Field Painting - the painting that is done to new or rebuilt structures at the place of erection either before or after erection.

Flexibility - the property of coating films which allows them to follow bending, stretching, or shrinking of the substrate without cracking or loss of adhesion or adhesive qualities.

Floating - the separation of one pigment from a mixture during the drying of the film. This separation is usually visible as a color change.

Flow - the ability of a paint to spread evenly into a thin film.

Flow coating - a system of applying finishes by allowing the coating material to flow over the surface.

Fugitive - unstable or not permanent.

Fungicides - Substances, usually chemical, that destroy fungi and their spores or inhibit their growth.

Fungus - a vegetative or animal organism such as mold, mildew, and smut.

Gelling - the process by which a liquid coating material loses its ability to flow and becomes rubbery.

Gloss - the property of a surface by which it reflects light specularly; luster, shininess.

Gloss Retention - the property of retaining the original gloss of a coating.

Hairlines - very fine lines, often invisible to the unaided eye, which appear on the paint surface.

Hammer Finish - a finish that resembles a hammered surface.

Hardness - the property of a surface that permits it to resist penetration or scratching.

Hiding Power - the power of a paint to hide a surface painted with it. May be expressed in terms of square feet per gallon on standard cards such as Morest test cards.

Holidays - areas that have been missed on one or more coats of paint which results in a lack of paint film thickness and an irregular appearance.

Hold Out - the ability of a primer to seal an underlying porous surface and prevent uneven gloss or color in top coats due to unequal absorption.

Hydrocarbons - compounds containing only hydrogen and carbon such as mineral spirits and benzene.

Hydrophobic - water repellent; not readily wet by water.

Hygroscopic - readily absorbing and retaining water from the air.

Inhibitor - a chemical substance or mixture which effectively decreases corrosion.

Ion - An electrically charged atom or group of atoms. Anions are negatively charged and cations are positively charged.

Inerts - SEE EXTENDERS

Japan - a varnish yielding a hard, glossy, dark colored film. Japans are usually dried by baking at relatively high temperatures.

Japan Drier - a resinate base liquid drier.

Kit - a unit of coating containing necessary ingredients for a mix.

Latex - originally, the juice of the rubber tree from which natural rubber was recovered. Later the term was applied to any fine dispersion of rubber, natural or synthetic, in water. Now latexes include a number of dispersions of synthetic resins in water which are used for paint vehicles.

Let Down - to mix or dilute with a cheaper material to decrease the cost and improve other properties. Often used for dilution with solvent.

Leveling - the ability of a coating to form a smooth, level film on either a horizontal or a vertical surface.

Lifting - the softening and penetration of a film by the solvents of another film which result in raising and wrinkling.

Livering - an increase in the consistency of a paint or enamel resulting in a rubbery and coagulated mass.

Maintenance Painting - the painting of structures in service that have previously been completely painted require touch - up or repainting.

Mar Resistance - the resistance to marring of a dry film.

Masking - the process of temporarily covering areas of a surface to prevent the application of paint to areas where it is not wanted.

Mastic - any liquid or paste composition which yields a thickness between 10 mils and 1/16" in one coat over a corrodible metal base.

Mil - a unit of thickness equal to 1/1000 inch.

Mildew - a superficial growth on paint films which is produced by a fungus.

Non-Drying Oil - an oil which does not of itself possess to a perceptible degree the power to take up oxygen from the air and lose its liquid characteristics.

Naphthas - Hydrocarbons derived from petroleum or coal tar, which are widely used as solvents.

Non-Volatile - that portion of a liquid coating which does not evaporate.

Nonvolatile Vehicle - the liquid portion of a paint excepting or excluding its volatile thinner and water.

Oil color - an oil paint containing a high concentration of colored pigments used for tinting paint.

Oleoresinous - a mixture made of or containing both drying oil and resin which is usually cooked to form a varnish.

Orange Peel - a surface in which small circular bumps appear on the film surface.

Organic Coatings - a general term for paints, varnishes, and lacquers.

Oxidation - a chemical process by which oxygen is united with some other substance. Most drying oils dry by oxidation.

Paint - a mixture of pigments and vehicles and appropriate additives to form a film or covering to protect the surface for a reasonable time and to leave an attractive appearance on wood, metal and masonry. Paint includes enamels, varnishes, emulsions, bituminous coatings, and other organic coatings.

Painting - the series of operations that includes the surface preparation, pretreating, and application of paints to surfaces whether in the shop or in the field; it usually includes the supplying of labor, material, and equipment as well as the drying and protection of the painted surfaces - including protection of property and traffic.

Pass - (Spraying) - the operation of moving a spray gun across the object being painted.

Permeability - the degree to which a film, or membrane permits the passage of gas, vapor, or liquid.

Pigment - the insoluble material carried to the surface by the vehicle.

Pigment active - those pigments which contribute to color opacity or corrosion resistance to the film.

Pigment Inert - those pigments which do not contribute color opacity but which are added to reinforce the film, to control gloss, to increase "build," or the lower the cost.

Pin-Holing - a paint condition characterized by the presence of tiny holes in the paint film.

Pitting - a condition in which the paint film is marked by fine holes which do not go through to the substrate.

Plasticizer - a substance added to paint, varnish, or lacquer to impart flexibility.

Polyvinyl Acetate - a synthetic resin made by polymerizing vinyl acetate, either by itself or with additives. It is largely used in its emulsion form as a vehicle for latex paints. It is often called "PVA".

Porosity - the property of a paint film which permits the passage of liquids, gases, or vapors.

Pot Life - refers to the duration of time during which the material remains useable after mixing curing agent with base material.

Preservatives - water-repellent preservatives such as pentachlorophenol will lengthen the life of most wood used outside. Pressure applications of water repellent preservatives are recommended when available. The life of any seasoned posts or any seasoned wood is lengthened for underground use by treating with a wood preservative and a liberal coating of asphalt tar.

Pressure Pot - a container for paint to which pressure can be applied. It is used in spray or roller painting.

Primers - special first-coat paints designed to provide adequate adhesion and a base for finish coats.

Reduce - adding thinner to lower the viscosity of a coating material.

Reducer - a thinner added to a coating.

Reduction - the effect of adding thinner to a coating material.

Resin - (Natural) - a solid organic substance originating in the secretion of certain plants or insects which is thermoplastic, flammable, non-conductive or electrical; breaks with a conchoidal fracture (when hard) and dissolves in certain specific organic solvents but not water.

Resin Synthetic - a synthetic substance physically similar to natural resin.

Rosin - a resin extracted from pine logs or sap.

Sags - areas of uneven coating produced by the flow of excessively thick layers of wet coating.

Salt Spray - a test method which exposes coated panels to mists of salt solution until the underlying metal starts to corrode.

Sandblasting - a process for cleaning a surface by air-borne sand prior to applying paint.

Seeding - the undesirable formation of relatively large particles in a coating due to agglomeration of the pigment or gelation of the vehicle.

Settling - Gravity separation of pigments in a paint.

Shade - the addition of black or complimentary colors to effect lower reflectance without change in hue.

Shelf Life - the period of time during which a packaged coating material may be stored and still remain suitable for use.

Silicone Resins - synthetic resins containing silicone as an essential component. Silicones have excellent resistance to heat, chemicals, and chalking.

Shop Painting - the painting that is done in a shop or plant before shipment to the site of erection.

Specific Gravity - the ratio of the density of a substance related to that of water.

Skips - areas of surface unintentionally left uncoated during the application of a film.

Solids - the nonvolatile ingredients of a coating.

Solvency - the ability of a liquid to dissolve a material.

Solution - the mixing of a substance with a liquid to form a homogeneous system without chemical reaction.

Solvent - a liquid, usually volatile, which will dissolve a material.

Solvent Power - the ability of a liquid to act as a solvent.

Spar Varnish - a durable, water-resistant varnish designed for severe exterior exposure.

Spreading Rate - the area covered by a unit volume of coating material frequently expressed as square feet per gallon; sometimes referred to as coverage.

Spewing - the migration of one or more components of a vehicle to the surface during drying.

Sponginess - a condition in which there are numerous small voids in the paint film.

Substrate - that which lies beneath and supports another.

Surface Preparation - a general term referring to the preparation which must be given a surface whether it be wood, metal, or other material before a coating is applied.

Surfacer - a pigmented composition for filling minor irregularities to obtain a smooth uniform surface prior to applying finish coats which is usually applied over a primer and sanded for smoothness.

Tackiness - the property of an incompletely dried varnish or enamel which allows it to catch and hold dust particles.

Tensile Strength - the resistance of a material to be drawn out into long thread-like pieces.

Thermoplastic - the term applied to materials which become soft when heated and harden again when cooled.

Thinner - a volatile organic liquid used to adjust the consistency of a coating. Also it is that portion of the coating which evaporated during the drying process.

Tint - the addition of a white to a color to effect higher reflectance without change in hue.

Titanium Dioxide - a white pigment used in paints and enamels. It has the highest brightness and hiding power of the white pigments.

Tolvol - a colorless liquid widely used as a solvent in lacquers and synthetic enamels. It is also called "Tolvene".

Toner - an organic color having no inorganic ingredients.

Touch-Up Painting - the preparation and repainting of marks, scratches, or small areas of painted surface to restore the coatings to an integral or unbroken condition.

Toxicity - the quality, state, or degree of being poisonous.

Trade Sales - in the paint industry, trade sales are all sales to jobbers, dealers, contractors, Painters, Automotive Refinishing Shops, and sales made directly to the consumer for maintenance painting for all types of buildings and structures.

Tumber coating - a method of applying coatings to small objects by which the objects and coating are placed in a barrel which is rotated to distribute the coating uniformly.

Undercoat - a coating film applied in preparation for a finish coat to be applied over it.

Undertone - the color of a thin pigmented film when viewed by transmitted light.

Vapor Degreasing - a method of cleaning surfaces, particularly metals, which allows vapors of a boiling solvent to condense on the surface and run off carrying grease and dirt with them.

Varnish - a transparent or translucent coating which may be a resin dissolved in a solvent, which dries by solvent evaporation, only, or a solution of a resin in an oil which dries by oxidation of the oil.

Vehicle - the liquid portion of any paint, enamel, or lacquer.

Vinyl - a synthetic resin made from vinyl compounds.

Viscosity - a measure of the resistance of liquids to flow.

Water Base Paints - usually a misnomer for emulsion paints.

Weatherometer - Laboratory equipment for evaluating the weather resistance of coatings by accelerating conditions which they might be expected to face in service.

Wet Film Thickness - the original thickness of coating as applied before evaporation of the solvent.

Wrinkling - formation of small ridges or folds on the surface of a paint film.

Yellowing - a change in which clear, white or light-colored coatings acquire a yellow cast due to chemical changes.

A List of Major Paint and Painting Equipment
Companies and Their Addresses

Devilbiss Manufacturing Company
520 Wharton Circle
Atlanta, GA 30336

Graco, Inc.
P. O. Box 1441
Minneapolis, MN 55440

National Paint, Varnish and Lacquer Association, Inc.
1500 Rhode Island Avenue, N. W.
Washington, D. C. 20005

Steelcote Manufacturing Company
St. Louis, Missouri 63155

Avolite
Atlantic Varnish and Paint Company, Inc.
Richmond, VA 23219

The Glidden Company
Cleveland 14, Ohio 44101

Parks Corporation
Somerset, Massachusetts

The Martin Senour Company
Administrative Office
Chicago, IL 60607

Pierce and Stevens Chemical Corp.
P. O. Box 1092
Buffalo, New York 14240

The Sherwin Williams Company
P. O. Box 6027
Cleveland, Ohio 44101

Glidden Coatings and Resins
Cleveland, Ohio 44101

American Paint Products, Inc.
Washington, D. C. 20005

Luminall Paints, Inc.
Chicago, Illinois 60607

Olympic Stain-A Division of Comerco, Inc.
1148 N. W. Leary way
Seattle, WA 98107

Krylon Department
P. O. Box 930
Norristown, PA 19404

Sears
Chicago, Illinois 60607

E. I. duPont de Numours and Company, Inc.
Paint Division
Wilmington, DE 19898